

This listing of claims will replace all prior versions, and listings, of claims in the application.

**Listing of Claims:**

- 1-4. (Cancelled)
5. (Previously Presented) A method for forming an image model, comprising the steps of:
  - developing imaging system characteristics;
  - developing gross shape;
  - developing microstructure; and
  - incorporating the imaging system characteristics, the gross shape and the microstructure to form the image model, wherein:
    - the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics;
    - the data likelihood is developed using image pixel based statistics and comprises the steps of:
      - a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean value to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;
      - b. classifying each pixel as Rayleigh or Gaussian determined by the ratio of the amplitude mean value to the standard deviation value;
      - c. assigning a density function to each image pixel based upon the classification of each image pixel; and
      - d. constructing the data likelihood as a product of the density functions.
6. (Original) The method of claim 5, wherein constructing the data likelihood assumes an independence between each image pixel.
7. (Original) The method of claim 5, wherein the image model is physically-based and the order of the steps permits inclusion of the imaging system characteristics, the

gross shape and the microstructure at each image pixel without violating the physical image model.

8. (Original) The method of claim 5, wherein computation of the amplitude mean and the amplitude variance value is non-trivial, requiring calculation of multiple integrals for each pixel.

9. (Original) The method of claim 5, wherein the density function describes an echo amplitude of a respective image pixel.

10. (Original) The method of claim 5, wherein the data likelihood is suitable for performing pose estimation.

11-12. (Cancelled)

13. (Previously Presented) A method for forming an image model, comprising the steps of:

developing imaging system characteristics;

developing gross shape;

developing microstructure; and

incorporating the imaging system characteristics, the gross shape and the microstructure to form the image model, wherein tissue is characterized by a reflectivity function that comprises a sum of scaled three-dimensional delta functions.

14. (Previously Presented) A method for forming an image model, comprising the steps of:

creating a physical model of image formation; and

creating a random phasor sum representation of the physical model to form the probabilistic model.

15. (Previously Presented) The method of claim 14, wherein creating the physical model of image formation comprises the steps of:

- forming imaging system characteristics;
- forming microstructure; and
- incorporating the imaging system characteristics and the microstructure to

create the physical model.

16-17. (Cancelled)

18. (Previously Presented) A method for forming an image model, comprising the steps of:

- creating a physical model of image formation; and
- creating a representation of the physical model to form the probabilistic

model, wherein the representation is a data likelihood created from a random phasor sum representation of the physical model.

19. (Previously Presented) The method of claim 18, wherein the data likelihood enables a statistical inference to formulate underlying characteristics.

20. (Previously Presented) The method of claim 18, wherein the data likelihood is constructed using image pixel statistics by assigning a density function to each image pixel and constructing the data likelihood as a product of the density functions.

21. (Previously Presented) The method of claim 20, wherein constructing the data likelihood further comprises:

- computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean value to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

- classifying each pixel as Rayleigh or Gaussian determined by the ratio of the amplitude mean value to the standard deviation value;

assigning the density function to each image pixel based upon the classification of each image pixel;

22-23. (Canceled)

24. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

creating a physical model of image formation; and

creating a representation of the physical model to form the probabilistic model, wherein the representation is a random phasor sum representation resulting from a linear model of a radio frequency image portion of the physical model, the radio frequency image portion being characterized by a point spread function.

25. (Original) The method of claim 24, wherein tissue is characterized in the radio frequency image portion by a reflectivity function.

26. (Original) The method of claim 25, wherein tissue is characterized in the radio frequency image portion by a discrete scatterer model.

27. (Original) The method of claim 26, wherein the discrete scatterer model includes multiple discrete scatterers distributed across a surface of the gross shape.

28. (Original) The method of claim 27, wherein spatial location of the discrete scatterers distributed across the surface is parametrized by a scatterer concentration and a surface roughness.

29. (Original) The method of claim 27, wherein each discrete scatterer is a sub-wavelength perturbation in the surface that scatters strongly in the direction of a transducer.

30. (Original) The method of claim 27, wherein each discrete scatterer contributes a phasor to the random phasor sum representation of the physical model.

31. (Cancelled)

32. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

creating a representative physical model of image formation wherein creating the physical model includes:

forming imaging system characteristics;

forming shape; and

forming microstructure using image pixel-based statistics comprising the steps of:

a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

b. classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;

c. assigning a density function to each image pixel based upon the classification of each image pixel; and

d. constructing the data likelihood as a product of the density functions; and

incorporating the imaging system characteristics, the shape and the microstructure to create the physical model; and

creating a representation of the physical model to form the probabilistic model.

33. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

a. creating a representative physical model of image formation, including:

i. formulating a deterministic description of imaging system characteristics,

ii. formulating a deterministic description of gross shape,

- iii. formulating a random description of microstructure, and
  - iv. incorporating the imaging system characteristics, the gross shape and the microstructure to form the model; and
- b. creating a random phasor sum representation of the physical model to form the probabilistic model.

34-35. (Cancelled)

36. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

- creating a representative physical model of image formation; and
- creating a representation of the physical model to form the probabilistic model, wherein the representation is a random phasor sum representation resulting from a linear model of a radio frequency image portion of the physical model, the radio frequency image portion being characterized by a point spread function.

37. (Original) The computer readable medium of claim 36, wherein tissue is characterized in the radio frequency image portion by a reflectivity function.

38. (Original) The computer readable medium of claim 37, wherein tissue is characterized in the radio frequency image portion by a discrete scatterer model.

39. (Original) The computer readable medium of claim 38, wherein the discrete scatterer model includes multiple discrete scatterers distributed across a surface of the gross shape.

40. (Original) The computer readable medium of claim 39, wherein spatial location of the discrete scatterers distributed across the surface is parametrized by a scatterer concentration and a surface roughness.

41. (Original) The computer readable medium of claim 39, wherein each discrete scatterer is a sub-wavelength perturbation in the surface that scatters strongly in the direction of a transducer

42. (Original) The computer readable medium of claim 39, wherein each discrete scatterer contributes a phasor to the random phasor sum representation of the physical model.

43. (Cancelled)

44. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

- creating a representative physical model of image formation; and
- creating a representation of the physical model to form the probabilistic model, wherein the probabilistic model is formed using image pixel-based statistics comprising the steps of:
  - a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;
  - b. classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;
  - c. assigning a density function to each image pixel based upon the classification of each image pixel; and
  - d. constructing a data likelihood as a product of the density functions.

45. (Cancelled)

46. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

- a. creating a representative physical model of image formation, including:

- i. formulating a deterministic description of imaging system characteristics,
  - ii. formulating a deterministic description of gross shape,
  - iii. formulating a random description of microstructure, and
  - iv. incorporating the imaging system characteristics, the gross shape and the microstructure to form the model; and
- b. creating a random phasor sum representation of the physical model to form the probabilistic model.

47. (Previously Presented) A computer readable medium that stores a program to form a physically-based, probabilistic model for ultrasonic images, the program comprising:

- a. means for creating a representative physical model of image formation; and
- b. means for creating a random phasor sum representation of the physical model to form the probabilistic model, wherein the representation is a data likelihood created from the random phasor sum representation of the physical model.

48. (Cancelled)

49. (Original) A computer readable medium that stores a program to perform image pixel based statistics, the program comprising:

- a. means for computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;
- b. means for classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;
- c. means for assigning a density function to each image pixel based upon the classification of each image pixel; and
- d. means for constructing the data likelihood as a product of the density functions.



50. (Previously Presented) A computer readable medium that stores a program to form a physically-based, probabilistic model for ultrasonic images, the program comprising:

- a. means for creating a representative physical model of image formation, including:
  - i. means for developing a deterministic description of imaging system characteristics,
  - ii. means for developing a deterministic description of gross shape,
  - iii. means for developing a random description of microstructure, and
  - iv. means for incorporating the imaging system characteristics, the gross shape and the microstructure to form the physical model; and
- b. means for creating a random phasor sum representation of the physical model to form the probabilistic model.

51-54. (Cancelled)